

said matrix thereat is of open-pore construction and defines surface asperities by which said optimal distribution of polishing slurry during chemical mechanical polishing of substrates is achieved, so that polishing slurry may be readily absorbed and optimally distributed during chemical mechanical polishing of substrates, said process comprising:

- (a) making said polishing pads using a wet laid paper-making process;
- (b) said step (a) comprising forming a slurry of at least water, paper-making fibers, and latex;
- (c) mixing said slurry of said step (b) in order to disperse the fibers;
- (d) delivering said mixed slurry to a paper-making apparatus, and forming a wet-laid sheet;
- (e) drying the wet-laid sheet of said step (d);
- (f) adding and curing thermoset resin binder;
- (g) said step (f) comprising at least one of: adding the thermoset resin during said step (b), and after said step (e);
- (h) cutting the sheet to form polishing pads of desired size;
- (i) grinding at least one surface face of each said polishing pad to form said asperities and to open the porous matrix for polishing slurry transport during CMP processes; and
- (j) adding nanometer-sized conditioning-reinforcing filler particles so that each said ground polishing surface is reinforced to improve resistance to wear during conditioning of said ground polishing surface by a conditioning disk so that said polishing surface requires less frequent and less vigorous conditioning after repetitive uses.

Amend claim 2 as follows.

CLAIM 2(AMENDED). The process of making polishing pads according to claim 1, wherein said step (h) is performed before or after said step (f).

Amend claim 3 as follows.

CLAIM 3(AMENDED). The process according to claim 1, wherein:

said step (f) is performed after said step (e) and comprises impregnating the dry sheet of said step (e); said step of adding conditioning-reinforcing filler particles of said step (j) comprising adding said conditioning-reinforcing filler particles to said thermoset resin of said step (f) to form a mixture thereof.

Amend claim 4 as follows.

CLAIM 4(AMENDED). The process according to claim 3, wherein:

said step of impregnating of said step (f) comprises saturating the dry raw paper of said step (e) in said solution of thermoset resin and said conditioning-reinforcing filler particles.

Amend claim 5 as follows.

CLAIM 5(AMENDED). The process according to claim 3, wherein:

said step of impregnating of said step (f) comprises saturating the dry raw paper of said step (e) in said solution of thermoset resin and said conditioning-reinforcing filler particles having a solids ratio of thermoset resin to conditioning-reinforcing filler particles in the range of approximately 20:1 to 1:1 by weight.

Amend claim 6 as follows.

CLAIM 6(AMENDED). The process according to claim 1, wherein:

said step (f) is performed after said step (e) and comprises impregnating the dry sheet of said step (e); said step (j) being performed before said step (f) and comprising saturating the dry sheet of said step (e) in a colloidal mixture of said conditioning-reinforcing filler particles.

Amend claim 7 as follows.

CLAIM 7(AMENDED). The process according to claim 3, wherein said step (f) further comprises at least one of: pressing the thermoset resin via a hard-roll squeeze nip into the paper; vacuum-pulling the thermoset resin into the paper in order to ensure resin penetration into the center of the material; and wiping off excess resin therefrom.

Amend claim 8 as follows.

CLAIM 8(AMENDED). The process according to claim 1, wherein said step of adding of said (j) comprises:

(k) adding spherical-shaped or platelet-shaped conditioning-reinforcing filler-particles of between 2 - 130 nanometers in size.

Amend claim 9 as follows.

CLAIM 9(AMENDED). The process according to claim 8, wherein said step of adding of said (k) comprises adding colloidal silica particles.

Amend claim 10 as follows.

CLAIM 10(AMENDED). The process according to claim 1, wherein said step (j) is performed during said step (b); said step (b) comprising forming a slurry consisting of the following base fiber matrix, by weight: 40 to 95% cellulosic fiber, 1 - 30% colloidal silica, and 1 - 20% latex at a raw base density of from approximately 0.200 to 0.500 g/cc.

Amend claim 11 as follows.

CLAIM 11(AMENDED). The process according to claim 1, wherein:

said step (f) is performed after said step (e) and comprises impregnating the dry sheet of said step (e); said step of adding conditioning-reinforcing filler particles of said step (j) comprising adding said conditioning-reinforcing filler particles to said thermoset resin of said step (f) to form a mixture thereof;

said step of impregnating comprising immersing said sheet of said step (e) in a bath of thermoset resin solution consisting of thermoset resin and said conditioning-reinforcing filler particles until completely saturated with the saturant solution; and removing excess resin and evaporating the solvent; said step (k) forming a resin-impregnated matrix with a colloidal filler content of between 1%-30% by weight.

Amend claim 12 as follows.

CLAIM 12(AMENDED). The process according to claim 1, wherein said step (f) comprises adding thermoset resin in an amount in order that each said polishing pad has thermoset resin-content in the range of 20% - 60% by weight.

Amend claim 13 as follows.

CLAIM 13(AMENDED). The process according to claim 1, wherein said step (i) comprises grinding with grit size of approximately between 320 and 36 grit to form asperities in the approximate range of between 2 - 35 micrometers in each of height, width and length.

Amend claim 14 as follows.

CLAIM 14(AMENDED). The process according to claim 1, wherein said step (i) comprises grinding both surfaces faces of each said polishing pad to a desired final thickness.

Amend claim 15 as follows.

CLAIM 15(AMENDED). The process according to claim 1, further comprising:

(k) forming grooves in the polishing-surface face of each said polishing pad to a depth less than the thickness of the polishing pad.

Amend claim 16 as follows.

CLAIM 16(AMENDED). The process according to claim 15, wherein said step (k) comprises forming arc-radial grooves.

Amend claim 17 as follows.

CLAIM 17(AMENDED). The process according to claim 16, wherein said step (k) comprises forming between 5 and 40 arc-radial grooves with each said groove having a depth between approximately 50% to 90% of said final thickness.

Amend claim 18 as follows.

CLAIM 18(AMENDED). The process according to claim 15, wherein said step (k) comprises forming each said groove to a width of between approximately 1/16 in. and ½ in.

Amend claim 19 as follows.

CLAIM 19(AMENDED). The process according to claim 15, wherein said step (k) comprises forming each said groove to a depth of within approximately 0.005 – 0.015 in. of the total pad thickness.

Amend claim 20 as follows.

CLAIM 20(AMENDED). The process according to claim 1, wherein said step (i) comprises removing approximately 0.010 to 0.020 in. from the polishing surface in order to remove the resin-rich skin layer and to open the porosity of the pad.

Amend claim 21 as follows.

CLAIM 21(AMENDED). The process according to claim 20, wherein said step (i) further comprises: removing up to 0.015 in. from the surface opposite said polishing surface for thickness control.

Amend claim 22 as follows.

CLAIM 22(AMENDED). The process according to claim 1, wherein said step (i) comprises grinding the polishing surface with a 60 – 120 grit media.

Amend claim 23 as follows.

CLAIM 23(AMENDED). The process according to claim 1, wherein said step of adding of said step (j) is performed during said step (b); said step (b) further comprising lowering the pH in order to retain the conditioning-reinforcing filler particles in said slurry.

Amend claim 24 as follows.

CLAIM 24(AMENDED). The process according to claim 23, wherein said step of lowering the pH comprises lowering the pH to approximately between 4 and 5.

Amend claim 25 as follows.

CLAIM 25(AMENDED). The process according to claim 1, wherein said step (e) dries said sheet to a nominal dry basis of approximately 531 pounds/3000ft² +/- 10%.

Amend claim 26 as follows.

CLAIM 26(AMENDED). The process according to claim 1, wherein said step (e) comprises drying said sheet to a thickness of between approximately .050 to .100 in. and to an approximate 1% moisture content.

Amend claim 27 as follows.

CLAIM 27(AMENDED). The process according to claim 1, wherein said step (b) comprises forming a slurry consisting, by weight, of: 40-95% cotton linters, 1-10% lyocell fiber; 1-30% latex binder.

Amend claim 28 as follows.

CLAIM 28(AMENDED). The process according to claim 1, wherein said step (b) comprises forming a slurry consisting, by weight, of 90% cotton linters, 10% latex and 5% 15- nanometer colloidal silica particles; and at least one of a colloidal-silica particle-retention agent and a pH-lowering agent for retaining the colloidal silica.

Amend claim 29 as follows.

CLAIM 29(AMENDED). The process according to claim 1, wherein said step (b) comprises forming a base-paper slurry consisting of: 70-80% cotton linters at a contamination level of 0.25 parts per million, 8-12% lyocell fiber, 8-12% acrylonitrile latex, and 3-10% colloidal silica.

Amend claim 30 as follows.

CLAIM 30(AMENDED). In a method of making a fiber matrix for use in making polishing pads for use in chemical-mechanical process apparatuses for the chemical-mechanical polishing of substrates, the improvement comprising:

said fiber matrix being made by a paper-making wet-laid process comprising the following steps:

- (a) mixing paper-making cellulosic fibers and nanometer-sized filler particles in water to form a paper-making slurry;
- (b) delivering the paper-making slurry of said step (a) to a paper-making machine and making a paper sheet in said paper-making machine;
- (c) said step (b) comprising draining water from the slurry to form a continuous paper sheet;